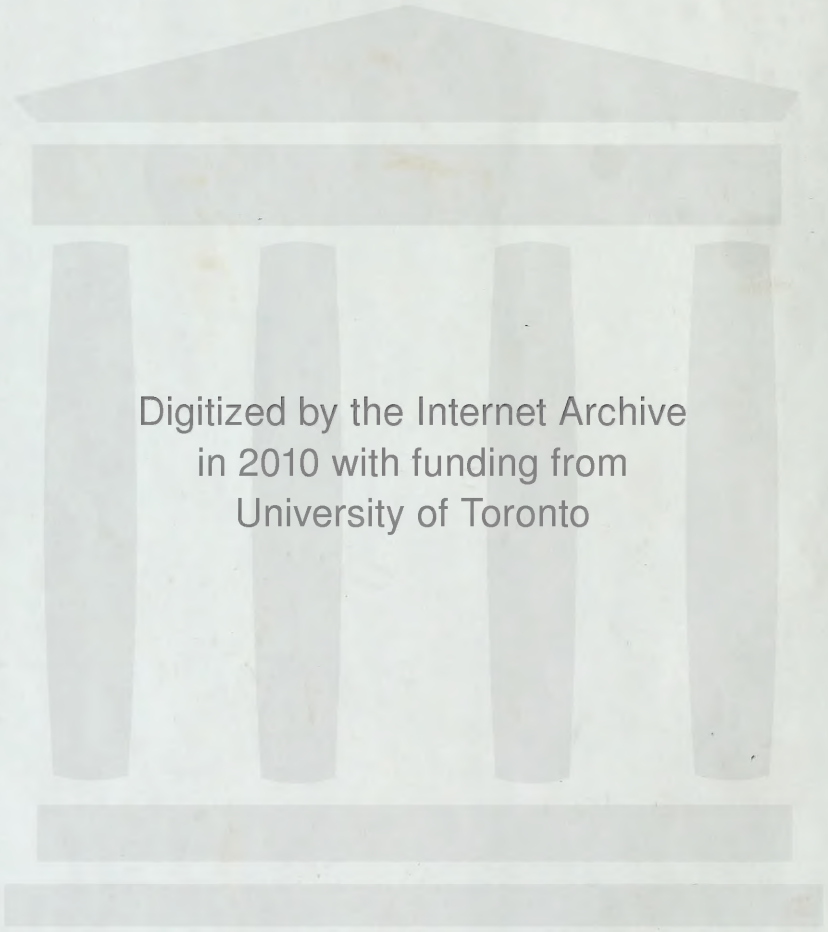
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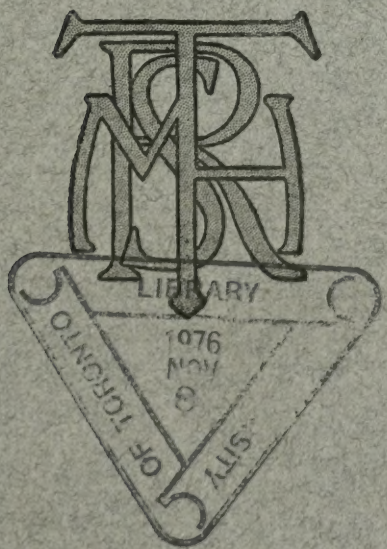

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FEBRUARY 16TH, 1922.

VOLUME XV. No. 8.

DEATH OF SIR PATRICK MANSON, G.C.M.G., F.R.S.

As this number of the TRANSACTIONS went to Press, the sad news of Sir PATRICK MANSON's death on Sunday, April 9th, was received. On behalf of the Society, the Secretaries sent a wreath with an appropriate note to Lady MANSON. At the Memorial Service, held in St. Paul's Cathedral, on April 12th, the Society was represented by the President, Sir JAMES CANTLIE, K.B.E.

It is hoped in the next number of the TRANSACTIONS to publish an obituary notice, together with a photograph, of Sir PATRICK MANSON, the first President of the Society, who has been well named the "Father of Tropical Medicine."

Proceedings of a meeting of the Society held on Thursday, 16th February, 1922, at 8.15 p.m., at 11, Chandos Street, Cavendish Square, W. 1, preceded, at 7.45, by a Demonstration of Relapsing Fever Spirochætes in Lice,

Sir JAMES CANTLIE, K.B.E., F.R.C.S. *(President)*, in the Chair.

THE EPIDEMIOLOGY OF RELAPSING FEVER IN INDIA.*

BY

MAJOR F. W. CRAGG, I.M.S., *Central Research Institute, Kasauli.*

Relapsing fever and typhus have long been known to be associated with conditions of overcrowding, poverty and lack of personal cleanliness. We now know that these conditions are favourable to the spread of these diseases, because they are most favourable to Pediculus. The increasing rarity of both diseases in Europe in pre-war times is to be attributed to the gradual rise in the standard of living, and the corresponding rise in the standard of personal cleanliness, among the population. When, however, we come to consider the epidemiology of these diseases in India, we have to do with an entirely different set of conditions, and the problem is by no means so simple.

With the exception of the small fraction of the population which lives in the larger towns, the people are a simple peasantry, living by agriculture and the occupations directly connected with it. They are a conservative people, and though, with the security against aggression and against famine which they now enjoy, they are more prosperous, their habits and mode of life have probably changed little since the days of the Great Moghul. A comparison of Indian conditions with those of modern Europe is quite fallacious; overcrowding, judged by our arbitrary standard

*This paper when read before the Society was illustrated by Lantern Slides of Charts, which added greatly to the interest of the evening.

of so many cubic feet per person, is practically universal, but this is not from want of space or from the expense of building, but from custom; the people may be poor in possessions, but their wants are few and simple. The essential fact, from our present point of view, is that the standard of living and of personal cleanliness has not reached that point at which man ceases to harbour Pediculus, his natural parasite. It is well to keep in mind that until a certain standard of cleanliness, not natural among primitive peoples, is reached, the presence of this insect is to be expected. That by far the greater part of the Indian peasantry normally harbour lice will not, I think, be disputed by those who have experience of the country. I convinced myself last year, by actual observations, that this is true in the United Provinces. The fact of the presence of lice, therefore, loses much of its significance in the study of relapsing fever in India.

When I first began the study of relapsing fever, a year ago, it appeared to me that there were considerable difficulties in the way of an explanation of the epidemiology of the disease on the basis of transmission by the louse. In the first place, the seasonal incidence is the opposite of what one would expect from published work on the bionomics of Pediculus, and from the accounts of the disease elsewhere. It is stated, and with good reason, that louse infestation is at its height in the winter, and, though authorities are not very emphatic on the point, relapsing fever, like typhus, is generally said to be a winter disease. In the plains of northern India, where the difference between the winter and summer climates is extreme, epidemics of this disease reach their height in the hottest months of the year, and are cut short before the onset of the rains. Secondly, the disease is not so generally distributed as one would expect it to be. Bengal and Assam, and the southern part of the Peninsula, as far as the available records show, do not suffer from the disease. It is especially curious that Calcutta and Madras should escape while Bombay does not. Further, whereas in other parts of the world typhus and relapsing fever are associated, as one would expect them to be, in India major epidemics of the latter occur without, so far as we know, any typhus at all, although typhus is almost certainly endemic in the Himalayas, and could in any case be very easily introduced into India through the passes leading from Central Asia. There are other considerations which tended to lead one's thoughts in another direction. It has

been pointed out, in official communications which I was privileged to see, that the time of maximum prevalence of the disease coincides with the maturation of the spring crop. There is also a general impression that the disease is rural rather than urban. It happens also that the parts which have suffered most are the wheat-growing tracts. The disease is endemic in the Punjaub, which grows wheat, and apparently not in Bengal and the rice-growing tracts of Madras. In the United Provinces the western and central districts have suffered severely from the disease, and these are similar to the adjacent districts of the Punjaub, and grow wheat; the southern and eastern districts, which do not produce wheat, have never been so severely infected. Having in mind that relapsing fever is transmitted by two arthropods so dissimilar as the tick and the louse, a third vector, somehow connected with the wheat crop, appeared a possibility. It did not appear to me to be justifiable to accept the louse as the vector of the Indian disease without experimental proof.

The most important feature in the epidemiology of the disease in India, and the one most difficult to explain on the basis of louse transmission, is the occurrence, at long intervals, of very severe and widespread epidemics. Relapsing fever is undoubtedly endemic in northern India, but little is heard of it in normal times. In the Sanitary Reports of the United Provinces there are many consecutive years in which the disease is not mentioned at all. The major epidemics, which, fortunately, only appear once in a generation or so, rival the worst outbreaks of plague or cholera.

We learn from the old records that there was a severe epidemic in 1836 and 1837, another in 1862 and the following years. The next epidemic was that of which VANDYKE CARTER has left us such an admirable account. It was associated with the great famine of 1877 and 1878, and many of the cases seen by CARTER in Bombay were immigrants into the city from the famine-stricken areas in the north. Since then there have been many minor outbreaks recorded, particularly in the Punjaub, but none of these is comparable with that of 1877 and 1878. In the United Provinces the disease was recognised as epidemic in the western districts in 1911 and the following years, but there was no very marked effect on the total mortality as compared with the mean, a circumstance which suggests that the increased prominence of the

disease was due rather to a better recognition of minor outbreaks than to an increased prevalence.

THE 1917 TO 1920 EPIDEMIC.

In 1917, after an interval of forty years, another great epidemic began. It reached its height in 1918, but was still active in 1920. It certainly affected the Punjaub, the United Provinces, and the Central Provinces, and may have extended elsewhere. My own observations have been confined to the United Provinces, and the account of the epidemic which I now offer refers only to that area. An account of the disease in the Punjaub has been prepared by GILL, and will, I understand, be published shortly.* Unfortunately, he and I have worked by different methods, and our results are not easily comparable.

A preliminary word is necessary about the Indian vital statistics. There is, in the ordinary routine, no registration of the cause of death by medical men. The diagnosis, such as it is, is made by the friends of the deceased, and reported by the village watchman, who is required to distinguish by name only three diseases: plague, cholera and small-pox. Other causes of death are reported under the general headings—"respiratory disease," "diarrhœa and dysentery," "fever," and "all other causes." The reports are collected by districts, and eventually appear, duly tabulated, with the Annual Reports of the Sanitary Commissioners of Provinces. It might be thought that statistical material collected in this manner would have little value, but this is not the case. A great deal of valuable information can be obtained from it, if it is studied with a knowledge of local conditions and of the manner in which the figures are collected. The total number of deaths, the seasonal variations in mortality, the age at time of death, and the sex are reported with sufficient accuracy. The census reports provide a control for the general figures, and special investigations made from time to time control the diagnosis of the named diseases. On the whole, the village officials appear to carry out their task remarkably well. The statistics are satisfactory in practice because one is working on broad lines, dealing with only a small number of major diseases, any one of which may, for a few months, double and treble the death-rate. It is very necessary to appreciate how large a proportion of

*The writer had the privilege of seeing Colonel GILL's paper in manuscript.

the total number of deaths is due to epidemic disease. The mean annual death-rate in the United Provinces for the 20-year period 1898-1917 was 36·27 ; the lowest rate was 27·38, the highest 52·73, the high rates being due entirely to prevailing epidemics. The most important diseases are, of course, plague, cholera and malaria ; small-pox is now relatively unimportant, vaccination being an established and not unpopular institution. The seasonal prevalence of these diseases is an important point, particularly in the case of plague, as it happens that the plague season is near that of relapsing fever. Plague is at its lowest in July and August ; the death-rate from this disease rises during the cold weather, and reaches its highest point in March or April, according to the climate of the locality. Relapsing fever epidemics rise and fall about a month later than epidemics of plague.

The mean annual mortality for the 20-year period 1898-1917, when charted by months, shows two rises, the first including the months from March to June, the second the autumnal months. The autumnal rise is, of course, due to malaria. The first rise is partly accounted for by plague, but this cannot account for the whole of it, for we know that there is little plague in May in the United Provinces ; and, further, the rise is shown in a modified form in the 20-year period before the present outbreak of plague. The great variability of the death-rate from year to year, and the part which seasonal epidemics play in the production of the totals, is best brought out by calculating the standard deviation of the figures from which the 20-year mean is obtained. The autumnal months show the highest deviation, indicating the great variability of malaria from year to year. The figures for March and April are high on account of the varying intensity of plague. The figures for May and June are lower, which suggests that the prevalence of relapsing fever has been much the same in each of the twenty years.

I may add that the lower death-rates shown in the earlier period are to be attributed to less efficient registration, and that the deaths recorded each month from " fever " run generally parallel to the total deaths from all causes, except in the presence of epidemic plague or cholera.

We now pass on to consider the recent epidemic as it is reflected in the vital statistics. In the first quarter of 1917 the death-rate was practically normal. In April, however, there was a very definite rise, which was almost maintained in May. There was not enough plague or

cholera reported to account for this. The death-rate in the following months ran parallel with the mean, but was maintained above it till September. It is necessary to remark here that the autumnal rains failed in 1917, and that there was therefore little malaria. A sharp rise in December brought the death-rate to about 50 per cent. higher than in the first month of 1917. This rise was maintained in January, and from March the rate rose so sharply that in May, 1918, the death-rate was about 75 per cent. greater than the mean for that month. Thereafter the death-rate fell steadily until it reached the mean in August. We cannot follow the epidemic of relapsing fever through the rest of 1918, or in 1919, on account of the prevalence of influenza, which obscured all traces of other epidemics. The year 1920 was a most exceptional one, in that very little plague or cholera was reported. Relapsing fever was, however, still prevalent, and shows itself in a rise in May and June, rather later than usual.

The epidemic was not evenly distributed over the Provinces. The western districts, which are situated on the fertile plain between the Jumna and the Ganges, and are generally accounted the most prosperous in the Provinces, suffered the most. The death-rate in these districts at the height of the epidemic was more than two and a half times the mean for the same area. These districts suffered little in 1920.

Next to the seasonal prevalence, the most striking feature of the epidemic was the special incidence on young adults. I worked out the figures from the statistics of the Agra district, omitting the large towns, and taking the mean of the five years from 1912 to 1916 as a standard for comparison. The total deaths in each month are shown in vertical columns, divided into blocks representing the deaths at each age period. When the figures are thus arranged, it is seen that the deaths of infants and young children take little part in the production of the hot weather rise, this being due to an excess of deaths of adults. This is the case both in the mean and in the epidemic figures, but during the epidemic the feature was very greatly exaggerated. In the mean the deaths of infants and young children made up rather less than half the total deaths in May, whereas in 1918 the same age groups made up only a fifth. The point is brought out more clearly if we compare the deaths at each age group at successive stages of the epidemic, expressing the number of deaths for convenience as the number of times the mean. Taking the

age period twenty to thirty years, in December and January the death-rate was nearly five times the mean, in February and March about seven and a half times, and in April and May over fifteen times the mean. During the same periods the death-rate of children under one year was increased to less than one and a half times the mean, less than two, and just over three times the mean. The deaths from relapsing fever of infants and young children were probably much fewer than these figures indicate; the death-rate in May was 196·68 per annum, and of those who died, or were seriously ill, many must have had young children, for the parent age was most affected. Many children must have died from inevitable neglect.

The sex incidence of the disease is a little difficult to work out, as there is normally a considerable excess of males in the population. It is clear, however, that males suffer more than females. According to my calculation there should have been 108 males living in this district to every 100 females. In May, 1918, there were 128 deaths of males to every 100 deaths of females at the age period twenty to forty years.

As was to be expected from the preliminary considerations already commented on regarding louse infestation, caste and occupation were found to have no very marked effect on the incidence of the disease. The lower castes are probably most affected in small epidemics, but the prosperous agricultural castes do not escape.

An important problem presents itself with regard to the origin of the epidemic. Did it reach the United Provinces from elsewhere, or did it arise from a focus, or from many foci, within the Provinces? There is little doubt on this point. We have direct evidence of the existence of relapsing fever in many of the districts previous to 1917, and particularly of its prevalence in those districts which suffered most in 1917 and 1918. A rise in the death-rate at the season at which epidemics of this disease normally reach their height is a constant feature of the statistics. There is, therefore, no reason to assume that the epidemic originated elsewhere. A detailed study of the figures relating to the Agra district confirmed the view that the epidemic originated, as does an epidemic of malaria, from innumerable local foci. I could find no indications of any special focus in the district, or of any invasions from the surrounding districts. The conclusion is unavoidable that some common cause produced the epidemic from innumerable foci.

Although all the districts which were severely infected showed an increased death-rate in the last three quarters of 1917, the maximum intensity of the epidemic was reached earlier in some districts than in others. By the use of a method based on the seasonal prevalence and the special age incidence of the disease, I was able to estimate the relative severity of the disease in any district, irrespective of the total death-rate, which might, of course, be raised by an epidemic of another disease. I may add that I found this method most useful in the analysis of the statistics of past years, and by its aid was able to define an epidemic in 1896 which passed unrecorded at the time. The method fails in the presence of much cholera, and only one of the factors could be used in the years 1918 and 1919, on account of the prevalence of influenza. By the use of this "relapsing fever index" it was found that Shahjahanpur, to the east of the Ganges, was the most heavily infected district in 1917, the next in order being grouped round it, with an extension across the river to the Jumna-Ganges Doab. In 1918, Aligarh suffered the most, together with the surrounding districts in the southern part of the Doab. The prevalence of cholera in the hot weather in the southern districts obscures the situation. In 1919, the Doab districts were free, but there were indications of the presence of the disease in the eastern districts. In 1920 the disease was nowhere so severe, and the index was positive in only a few of the central and eastern districts.

The duration of severe epidemic conditions in any one district appears to be about two years. In April and May, 1917, the death-rate in Shahjahanpur was about three times the mean for that month, while in 1918 it was about twice the mean. In Aligarh the rise in 1917 was not very great, but in the following year the death-rate, at the height of the epidemic, was about five times that of the same month in a normal year.

Epidemics on so vast a scale call for more explanation than can be provided on the lines which have sufficed in the case of outbreaks in Europe. There was no change in the condition of the people at the time the epidemic began, no exceptional poverty, no special movement of the population. There was scarcity in 1918, on account of the failure of the monsoon of 1917, and scarcity conditions lead to an increased movement of the population, which may have been a contributory cause; but it is clear that the epidemic was well established before the

scarcity, which in any case was only slight as compared with the famines of other days, was felt by the people. There must be some additional factor, up to now unrecognised, in the epidemiology of the disease.

EXPERIMENTAL WORK.

I have already indicated the considerations which, at the beginning of my work, led me to doubt the rôle of the louse in the Indian disease. My first task was to endeavour to repeat the experiments by which the mode of transmission of the disease was demonstrated by the French workers. I met with many difficulties. Monkeys proved hard to get, on account of caste prejudice, and though I had taken all possible steps to get news of local causes at Agra, where I had arranged to work, I failed to find a single local case from which to infect a monkey directly. I eventually found an outbreak at Rohtak, in the Punjaub, about eight hours' journey from Agra, and brought back as many lice as possible from cases and convalescents. It is very difficult to keep lice alive in the hot weather, and casualties were many.

The lice were kept alive, mainly in wristlets, for the period which seemed most likely to give a successful result, and were then emulsified and injected subcutaneously into monkeys. Altogether 109 lice, the survivors of a much larger number collected at Rohtak, were divided between five monkeys. None of these developed a definite illness. The temperature charts were not much use as a guide, for the animals were then freshly caught and very wild, and during the first few weeks the excitement produced by the necessary manipulation was enough to raise the temperature. Later on, however, infective blood became available, for I developed the disease myself, ten days after a long and tiring morning spent in infected villages. Through the kindness of my medical attendant, 2 c.c. of blood containing spirochætes was injected subcutaneously into a fresh monkey. The temperature chart showed two rises, only the second of which, I think, is to be attributed to the infection. When I saw the animal on the sixth day it appeared to be definitely ill. Under anæsthesia I obtained 10 c.c. of blood from its heart, and of this 5 c.c. was injected subcutaneously into a fresh monkey, and 1 c.c. into each of the five which had previously been treated with lice. The monkey which received the 5 c.c. duly developed the disease. Of the other five, two had a definite two-day fever, with spirochætes in the

blood. Two had less definite rises, and unfortunately blood films were not taken systematically. The fifth monkey was a small one, a few months old. Though it had received the same dose of the same blood which had produced a definite infection in older and larger animals, the temperature only reached 104° F. on one evening, and no spirochætes were found in films made on that occasion. This seemed suspicious, and thick films which had been made previous to the injection of the blood were searched thoroughly. In a film made on the seventh day after treatment with possibly infected lice three spirochætes were found. This animal had received an emulsion of seventeen lice, removed six days previously from a patient seven days after the first relapse; in addition to the subcutaneous injection a large drop of the emulsion was placed in the conjunctiva. The temperature after this treatment was irregular, and on the fifth and sixth days was maintained at 104° F. It seems probable that there had been a mild infection from the treatment with lice, and that this had conferred on the animal sufficient immunity to enable it to resist the subsequent dose of infective blood.

The dissection of lice from cases of the disease, and after a single feed on an infected monkey, gave a more satisfactory confirmation of the work of the French investigators. The insects were dissected at intervals of from two to seventeen days after the last infecting meal. Of 67 lice from cases of the disease or from convalescents, spirochætes were found only in those of the seventh and eleventh days. Of 58 lice which had fed once on an infected monkey, spirochætes were found in those of the eighth, ninth and eleventh days.

The results are thus sufficient as provisional confirmation of the well-known experiments. I hope to have the opportunity of carrying out a more regular series of experiments at a future date.

THE BIONOMICS OF PEDICULUS UNDER HOT WEATHER CONDITIONS.

Accepting the louse as the vector of the Indian relapsing fever, we have to resolve the difficulties which I have already commented on. The solution of these difficulties is naturally to be looked for, in the first place, in the bionomics of the insect host, and I therefore carried out a large number of experiments, mainly directed to ascertain the reaction of the louse to the climatic conditions of the Indian plains in April and May. The

normal mean maximum temperature in the United Provinces in January, the coolest month, is 73° F.; in February, 77·4° F.; in March, 89·8° F. The hot weather may be said to begin about the middle of April, the normal for this month being 100·8° F. May is the hottest month, with a normal of 104·9° F. Towards the end of June there is an increase in atmospheric humidity owing to the advance of the monsoon, and the mean for this month is 101·3° F. There is thus a difference of about thirty degrees between the maximum temperatures of the coolest and the hottest months. These are, of course, the official records, taken under special conditions. To obtain data representing more closely the conditions under which Pediculus lives, I made a series of observations in an outhouse arranged to represent, as nearly as could conveniently be done, the conditions of an Indian dwelling. As might be expected, the humidity records were much higher than the official ones, the maximum temperatures lower and the minimum higher.

The many and varied experiments led to one definite result. In the cold weather, when the atmospheric temperature is definitely lower than the body temperature, the bionomics of Pediculus are the same in India as in Europe. The warmth of the body is necessary to it. Development is retarded if it is separated from its host at night. But as the temperature rises rapidly at the end of March and in April, the conditions are changed. The temperature and humidity of an ordinary Indian house become practically the optimum for this insect. It is to be noted that atmospheric conditions are far more important to lice living on the lightly clad Indian than they are when the host is a European, with many thicknesses of cloth between the skin and the external air. When, therefore, the temperature of the air approximates to that of the body, there is no slowing down of the metabolism of the insect if temporarily separated from its host. It becomes an exceedingly active insect. In one experiment which I carried out to test the reaction of lice to sunlight, the insect travelled altogether 32 feet 6 inches on a sheet of Bristol board, on one run achieving 17 inches in a minute, a speed far greater than previous records. Eggs are laid more freely, the incubation period is shortened, and the period of growth is reduced. As the season advances, however, the optimum is passed, and the more rapid metabolism is associated with an increased mortality. Towards the end of April and in early May the lice begin to die off, and I found in the United

Provinces, as was found in Mesopotamia, that they become very scarce when the hot weather has set in. Experiments carried out on the laboratory bench at that season gave much the same result as those carried out in incubators at home.

There is thus a cycle each normal year. During the cold weather the life history of the louse is much the same as in Europe, except that it is more susceptible to atmospheric conditions, being generally only separated from them by one or two thicknesses of cotton cloth; in the early part of the hot weather there is a period which is specially favourable to the insect: the extreme dry heat of May kills off all but a few. The application of this to the seasonal prevalence of relapsing fever needs little comment. The rise and fall of the disease is apparently determined by much the same climatic conditions as control plague, but, owing to the longer incubation period, the greater duration of the disease before death, and the period which must elapse before the louse becomes infective after the infecting meal, the death-rate from relapsing fever rises and falls later than that from plague by about a month.

THE EXCITING CAUSE OF THE RECENT EPIDEMIC.

The seasonal prevalence of relapsing fever in India is thus explained by the reaction of the insect host of the spirochæte to a varying climate. We have next to account for the origin of the great epidemics.

The explanation, when one has arrived at it, is very simple. The year 1917 was an altogether abnormal one. In the first quarter of the year there was nothing very unusual in the climatic conditons, but in April the mean maximum temperature was only 95° F., against a normal of 100·8° F. In May it was 95·5° F., which is nearly ten degrees below the normal. In June there was a deficiency of 3·3° F. The atmospheric humidity was in each of these months correspondingly high. The bearing of this on the incidence of relapsing fever is clear. The period during which optimum conditions for Pediculus prevailed was greatly extended, and the natural delousing which takes place in a normal May was greatly reduced. The endemic disease, not being cut short as it usually is, got a firm hold, and the number of cases continued to increase throughout the succeeding cold weather; when the period of optimum conditions arrived in the early months of 1918 it assumed the proportions of a formidable epidemic. The weather in May

and June of this year was normal, but one natural delousing did not suffice to stamp out so intense an epidemic, and it was not till 1921 that normal conditions were restored.

The hot weather conditions of 1917 are described in the official *Monthly Weather Review*, as "unique," and the writer goes on to say that the only years comparable with it are 1877, 1878 and 1885. No comparison could be more apt for our purpose, for the years 1877 and 1878 were those of the last great epidemic of relapsing fever. Enquiring further into the matter, we find that the Meteorological Reporter, commenting on the conditions of 1877, points out that the exceptionally low temperatures during the first half of that year were confined to northern India. He attributed the cold wave to the unprecedented snowfall in the Himalayas during the preceding winter. The temperatures in the south, including Madras, were higher than usual. Now, VANDYKE CARTER makes a point of the fact that, though Madras suffered equally with the rest of the country from the famine, relapsing fever was not prevalent there.

As regards 1885, I had only to do with statistics of the United Provinces, and there is no definite evidence in these of an epidemic that year; I have not seen the weather report, and am unable to say how the cold wave year was distributed. I have little doubt, however, that further study will show that the same cause produced the same effect wherever it acted. I have mentioned an epidemic in the United Provinces in 1896, an event which passed unrecorded at the time. I was not able to obtain the weather report—these old reports are difficult to get—but from the remarks of the Sanitary Commissioner it is clear that similar conditions of climate were responsible for the epidemic.

The low temperatures of 1877 were attributed to the excessive snowfall in the winter; the similar conditions in 1917 to excessive rainfall in the spring. In each case the rains failed in the succeeding autumn. There was a similar failure in 1896. The relation between famine and relapsing fever is not that of cause and effect, but it seems probable that they are to be traced to a common cause.

The practical importance of this conclusion is very great. Of all the diseases with which the sanitary officer in India has to do, none is more elusive than relapsing fever. The onset of the epidemic is slow, insidious, unobserved. The people, so accustomed to fever, are apathetic, uncomplaining, and unlikely to report a malady which has nothing dramatic

about it to attract their attention. The seasonal prevalence is near that of plague, and the most severely infected areas are often also plague stricken. But with a knowledge of the effect of climate on the prevalence of the disease we are forewarned. An exceptionally cool summer should lead to a critical examination of the monthly vital statistics for any excess deaths of young adults, and a local investigation and the examination of a few blood-films will settle the matter long before the epidemic reaches serious proportions.

I may add a word regarding the causes underlying the special incidence of the disease among young adults. I think this is connected with the mode of infection. NICOLLE says that all infested persons scratch themselves, and explains infection as occurring through the act of scratching, the integument of the louse being ruptured and the infective body juices inoculated by the same act. I doubt if this is the ordinary event. The integument of the louse, as a little experiment shows, is tough, and the amount and kind of force applied in casual scratching is not very likely to rupture it. Moreover, in India at least, infested persons do not scratch themselves much or vigorously. Having harboured these parasites all their lives, they are not much annoyed by them. Infants and young children are very unlikely to infect themselves in the way NICOLLE suggests, and this may explain their relative immunity. But it appears to me more likely that infection is normally brought about by the common practice of crushing the louse between the finger and thumb-nail. The body juices are thus brought into contact with the soft tissues under the nail, through which the spirochæte may be able to penetrate. In any event the nail is infected. The very young cannot delouse themselves in this way, and the very old are too indifferent.

The sex incidence may be explained, as has been suggested, I think, by BISSETT, by the greater liability of the males, who are mainly engaged in hard manual labour, to abrasions on the hand.

CONCLUDING REMARKS.

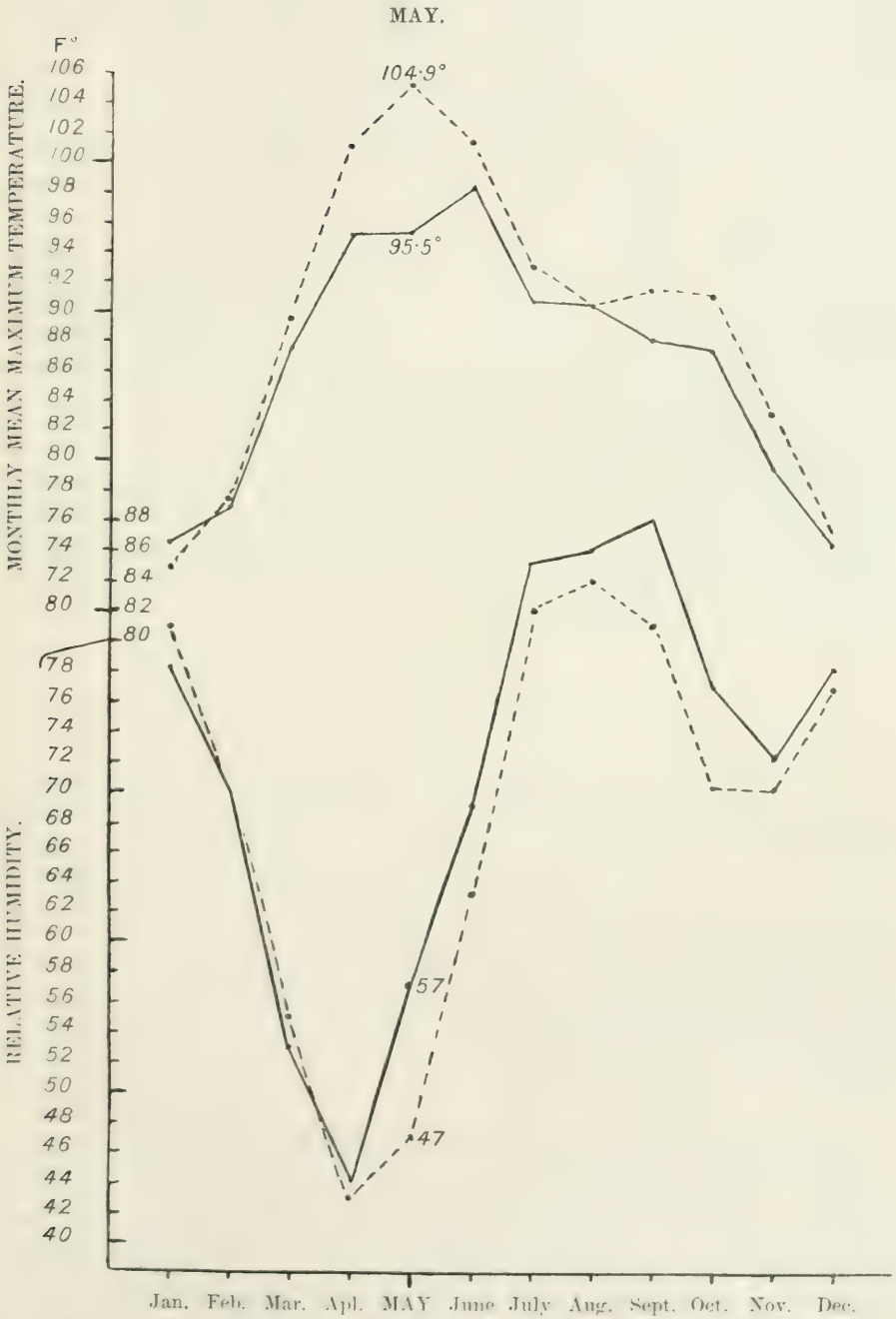
There are many questions still awaiting investigation. One of the most important of these is the prevalence of the disease in normal years. It appears probable that relapsing fever is responsible for a considerable part of the rise in the death-rate in April and May, which is a normal

feature of the vital statistics of northern India. The experience of those who have worked in other similar climates would be most interesting. One asks, as a preliminary question, Is extreme heat *per se* unfavourable to the life of the inhabitants of such climates?

The variation in the virulence of the infection is a subject of interest and importance. The variability, as shown by Indian experience, is very great. The virulence seems to be highest when the cases are most numerous, and it is possible that it is exalted by rapid passage. If the virulence becomes correspondingly reduced when the disease is quiescent, relapsing fever may be one of the perplexing group of "short fevers." CASEAUX met with cases so mild that the patient was able to continue his ordinary occupation.

The geographical distribution calls for investigation. The absence of the disease, or, at any rate, its rarity, in Bengal and Madras, may be accounted for on general grounds, such as the greater cleanliness of the people, the habit of anointing the body with oil, the very scanty clothing worn by many of the agricultural castes, etc., but such explanations do not appear wholly satisfactory. A study of the variations in the virulence of the infection, and of the nature of the immunity conferred by an attack of the disease, suggests itself as a promising line of enquiry. We know that the immunity after an attack does not last long. The seasonal prevalence of the disease has been traced to the seasonal changes in the climate of northern India. The cutting short of the epidemics in May must be followed by a progressive loss of immunity, and from the information we possess we must assume that even those who had a severe attack are again susceptible the following spring. Now in the parts with a more equable climate, which I may add are also the rice growing tracts as a rule, there is no such prolonged period during which climatic conditions render epidemics impossible. If the disease exists there, one would expect it to be in a mild form, for the people have no chance of losing their immunity to the infection. On such a hypothesis one would expect serious epidemics of relapsing fever to occur not in hot or cool climates, but in alternating climates, where the hot season is sufficiently pronounced almost to stamp out the disease, and thus to cause the population to lose their immunity.

The apparent absence of typhus is perplexing. The suggestion that



Temperature and humidity in the United Provinces in 1917 as compared with the normal.

the typhus organism can only develop under certain climatic conditions arises only to be dismissed, for until the atmospheric temperature is near that of the body it can hardly affect Pediculus. The possibility that it has been present, but not recognised, cannot altogether be put aside, for many medical officers must be under the disadvantage, as I am myself, of having had no experience of this disease. We know from the records left by the past generation, who had better opportunities of seeing the disease in their student days, that it was endemic in the Kumaon hills, and there is no reason to suppose it has died out. At present we are confronted with a curious phenomenon, that two diseases with the same insect vector have an entirely different seasonal prevalence and distribution within the borders of the same country.

In conclusion, I should add that a full report of the results of my enquiry into relapsing fever in the United Provinces of Agra and Oudh will, I hope, appear in due course in the *Indian Journal of Medical Research*. In this brief communication I have avoided dwelling on the statistical and experimental detail.

Discussion.

The President: We have just listened to a deeply interesting lecture, one made all the more interesting by the fact that Major Cragg did not read from his manuscript, but gave us of his own experience straight from his mind. I am sure you will feel thankful to him for the lucid way in which he has stated his case; it has been a great treat to us all. There are probably some here who have never seen relapsing fever, but I know there are some present who have, and we shall be glad if they will give us the benefit of their experience and impressions in connection with the disease.

Major H. C. Brown: I have been very interested in Major Cragg's lecture to-night, especially as I was sent down, in 1913, to investigate an epidemic of relapsing fever in the Meerut district also. What struck me most there was that it appeared to be particularly rife in the rural districts rather than in the towns. If one asked the civil surgeons what was their experience, they said: "You may get a few cases in the towns, but you

will not meet with it there in epidemic form, and there is no real severity about it." The villagers said that they did not know what the cause was, but they were certain it was something to do with the crops. Major CRAGG had mentioned that the disease occurred in the wheat-growing and not in the rice-growing districts. When people went into the fields to cut the crops, he noticed that when they took off their spare clothing before starting the work, they did not put it singly on the ground but in piles, which became even three feet high; and when the sun shed its rays on the clothing, the lice apparently made their way from the top to the cooler clothing beneath, thus bringing about a pretty thorough circulation and infection. This may explain to some extent the bigger proportion of cases in rural districts in comparison with the towns.

There was another possibility, which I suggested at the date when I was there, namely, that another vector might be one of the pentatomid bugs. During the mustard crop in May I counted, on a single twig of that plant, forty pentatomids. And I have seen the bug on threshing-floors, with many convalescents about, and I have noticed patients drawing up their legs and sweeping the bugs off because they were biting them. MARKHAM CARTER has proved that another pentatomid is capable of biting man, and I think some more work on this is required.

With regard to the sex incidence, I compiled a fair number of statistics there, and examined many more; and I found that not only was there a rise in relapsing fever in May, but also a December rise. I also found that in the May and December rises the males considerably outnumbered the females in the mortality from fevers.

Colonel H. J. BARRATT: I would like to make a few remarks with regard to the excellent paper which has just been read. I was in India at the time of the last relapsing fever epidemic which Major CRAGG has described, in 1917 and 1918, when I happened to be serving at Meerut. We had numerous cases at different stations: Saharunpur, Agra, Delhi, and other places, but it was in Meerut and Delhi that we had the largest incidence of cases, and, though I am speaking especially of military people, it was prevalent among the general population as well. As Major CRAGG says, it was in April and May that we had the very high death-rate. We had to supply a large number of coolies for the Labour Corps in connection with the War, and this necessitated a great deal

of movement among that class of the population, and we found they suffered very much from the disease.

We had enormous camps at various places, and thousands were passing through them every month. Some of these men seemed to have brought the sickness with them, and once such cases arrived in the camp, and proceeded to mix with others, it was easy to see how the disease was disseminated. We had to take the greatest care, therefore, in forming segregation camps for these Labour Corps men, where they could be examined and cleansed, and clothing and bedding disinfected, before mixing with the general camp population. But among the labouring classes there was one thing which struck us forcibly—it happened at Delhi and also at Meerut. New huts were being erected, built of brick, and with a thatched roof. The work was done by civil labour and coolies employed who had suffered from the disease. It was unavoidable—there was no alternative. Indian troops who had not had relapsing fever and who occupied these huts got the disease, and the question arose as to how they became infected. It was found that the coolies had brought the lice with them in their clothing and bedding, and had left some of them in the huts, so that when healthy men went to live in these huts they became infected. As soon as an infected case occurred, we isolated him, segregated the contacts, and disinfected his clothing and bedding as well as the place as far as possible. Owing to these sanitary preventive measures the disease eventually disappeared. There is no doubt that it is by the intermingling of large numbers of people that the widespread dissemination of the disease takes place, through the agency of lice harboured by convalescent or infected cases.

Colonel Clayton Lane: Major Cragg has referred to Darjeeling, and has alluded to the relationship between typhus and relapsing fever. Dukes described an epidemic in Darjeeling which was brought in from Sikkim. In this epidemic the sufferers had high fever, an enlarged liver and jaundice, and there were a number of deaths. It was only a small epidemic. There were no relapses—cases either got well or they died. The blood of these people contained spironema, and the slides from those cases were quite as striking as those exhibited here to-night. That was an anomalous condition, and one recognised that it was a difficult matter to say exactly what the disease was. Mackey said he could find no difference

between this spironema and that which was found in Bombay responsible for the relapsing fever there. I think it is due to the memory of an able medical officer to bring before the Society these observations.

Dr. ALDO CASTELLANI: I am interested in the observation made by Major CRAGG that epidemics of typhus and relapsing fever, though the two diseases are carried by the same insect, may not occur together. My experience in the Balkans and in Serbia, in 1915, was as follows:—We had typhus and relapsing fever there—a very large number of cases—until the beginning of July. In July typhus stopped quite suddenly, and from the end of July until October or November we had no other cases. But relapsing fever continued through the summer, and we had a fairly good number of cases of it.

I would like to ask Major CRAGG whether he has made any investigation on how long the period of infectivity lasts? I have seen a very large number of cases of relapsing fever in the Balkans, also at Corfu and in Poland, and I have the impression that the period of infectivity is much longer than is generally admitted. I think that the blood of the relapsing fever patient remains infective for several weeks, possibly months, after the last attack of the fever. In Macedonia and Corfu I investigated ten cases carefully, and found in four or five of them that, after the last typical rise of temperature, the temperature chart was not quite normal for four or five weeks; every fourth or fifth, or every seventh or eighth day, there was a slight rise, perhaps no more than to 99°F., and the patient was not feeling well. We found spirochætes in only one of the cases, but my impression is that the blood remains infective for several weeks, possibly months, after the last definite attack of fever.

Lieut.-Col. J. C. KENNEDY: I can bear testimony to Major CRAGG'S remark as to the prevalence of relapsing fever in the Kamaon district. I was stationed at Nainital, and we had the greatest difficulty in preventing relapsing fever being carried down to the plains by the coolies, of which Colonel BARRATT has spoken. We had large camps there, in which we collected the coolies who had been recruited for military duty. That was one of our greatest difficulties, to eliminate the carrying of relapsing fever from those parts down to the plains. From the military point of view, we had the idea that the relapsing fever which

was prevalent amongst the Indian troops originally came from the Hill districts.

Major F. W. Cragg: In reply to Major Brown, who mentioned the difference in the incidence of the disease in rural as against urban areas, I tried to ascertain details about that, but I was unable to get anything satisfactory from the statistics. I had the impression that relapsing fever was a rural rather than an urban disease; but it was a thing one could not be certain about, for facts concerning it are not easily ascertained.

As to the rise in incidence in the cold weather, there is a very definite rise in the total mortality in December and January in the United Provinces. I could not get evidence that it was due to relapsing fever; it is generally attributed to pneumonia. I do not know that the suggestion of pneumonia would explain the sex incidence which Major Brown mentioned. I would like to take this opportunity of expressing my thanks to Major Brown for the many valuable hints I got from him before I started this investigation. He was there in 1913; my visit was later.

Dr. Castellani mentioned that relapsing fever will go on longer than typhus, and I think an explanation of that may be found. If we were to delouse the entire population on one day, all the people who were going to die of typhus would die of it in ten to fourteen days. In the case of relapsing fever they might recover from the first attack, from the second, the third, even a fourth attack, and die from the next attack; and there is no doubt, as I found in my own case, that convalescence from relapsing fever is a very slow and difficult business, and any intercurrent disease coming along at that time would be a serious matter for the patient.

With reference to the period of infectivity, some of my experiments showed that lice can be infected from patients who have long recovered from their relapsing fever; but more observations are required on this point.

The President: I am sure you will join with me in thanking Major Cragg for his very learned paper.

COMMUNICATIONS.*

A NATIVE METHOD OF VACCINATION AGAINST SMALLPOX.

By W. E. HAWORTH, M.B., C.M., *M.O.H., Tanganyika Territory.*

"On the 24th June, 1921, Thomas Saidi, a Bondei native, from Kwasemgava, near Magila, called at the office to see one of the sanitary inspectors. Louis Mynah, clerk at the Health Office, to whom Saidi was well known by repute, brought him to the Medical Officer of Health, to whom he willingly gave an account of himself and his operations. He grows cassava on a shamba of his own, and also travels about the district adding to his income by inoculating people as a protection against smallpox. His fee is three cents, young children being operated upon free of charge. His outfit consisted of a common pocket-knife, a small pot filled with blue-black paste, and two bottles of a brown fluid. The last-mentioned he prepares from the fruit of two trees, one called mvungunya or mnyegea, the other mtenga. His method of preparing the paste is as follows: He takes some grass on which a person sick with smallpox has been lying, carries it in a cloth to the forest, and there burns it on a spot from which other grass has been cleared. He then gathers up the ash and mixes it with the juice of a tree called ngeza. After this he washes his body and clothes. In operating he disinfects the knife with fire, and with it he scarifies a place on the outside of the arm or front of the forearm, applies some of the brown fluid, and then rubs in a little of the paste. He states that two days after the operation the patient becomes sick with fever, which continues for four days, and that some of the patients become affected with smallpox afterwards, but have only mild attacks. On one occasion he operated on three men, and three weeks thereafter a child of one of them developed smallpox, and eight days later the father was attacked. Both were mild cases. The children of the other men also had smallpox, but, being away in another part of

*With a view to making the TRANSACTIONS more interesting, it is proposed to insert SHORT COMMUNICATIONS from Fellows relative to any matters of medical, sanitary or parasitological interest. It is felt that many Fellows in various parts of the world must be in a position to contribute short papers on these subjects, and the Secretaries will be pleased to receive any such from them.

the district, he did not know how long it was after he had inoculated the fathers. His father taught him the method, and he wrote down the directions for reference till thoroughly conversant with them by practice. When smallpox was prevalent, and many people required his services, he earned as much as Rs. 2 in a week. Last year he had operated upon many people, and on the morning of the interview had done so on a clerk in the District Political Office.

"He appeared to be quite sincere in his belief that he protected against smallpox, and to have no suspicion that his procedure was likely to cause the spread of the disease. His outfit was purchased for Rs. 4. He was then sent to the District Political Office, where he received a warning to desist from his practice. Possibly his method is a descendant of a form of inoculating the disease introduced from the East or from Europe."

A CHEAP FORM OF ARTESIAN WATER SUPPLY FOR VILLAGES IN THE TROPICS.

BY

E. P. MINETT, M.D., D.P.H., D.T.M. & H.

Government Medical Officer of Health, British Guiana.

The problem of a water-supply in British Guiana is not difficult as regards quantity, with a rainfall of about 100 inches per annum in a country the coastlands of which are four feet below high-tide level; but the quality of this surface water—conserved in shallow, almost stagnant, trenches and canals—leaves much to be desired. The water picks up about 4 grs. per gallon of peaty substances, and is of a brown sherry colour; in addition, these water trenches, running for miles, are liable to very serious pollution. The better-class houses are provided with vats or tanks for conserving rain-water, collected from the roofs; but this source of drinking-water is also open to many serious objections, both from the point of view of pollution and as lending itself to mosquito breeding.

About 1912, several artesian wells were sunk in the colony, in order to tap a pure water supply at considerable depth. The majority of these wells draw water from a depth of 500 to 600 feet. At first, considerable difficulty was experienced, owing to their gradually decreasing flow caused by silting up with fine sand. The well here described was fitted with a special strainer, designed by E. G. Buck, at that time Colonial Civil Engineer in the colony. The Nabaclis well is fitted with 8in. casing, and draws water from a depth of about 600 feet. The outflow has been fairly constant for the last six years at 250,000 gallons per day.

The water as it issues from the well is, however, not very palatable, owing to its containing a very considerable amount of iron in the ferrous state and, in addition, the temperature is about 95° F.; the water was, therefore, not popular with a people accustomed to rain-water cooled by storage in vats, barrels, etc., to a temperature of about 75° F.

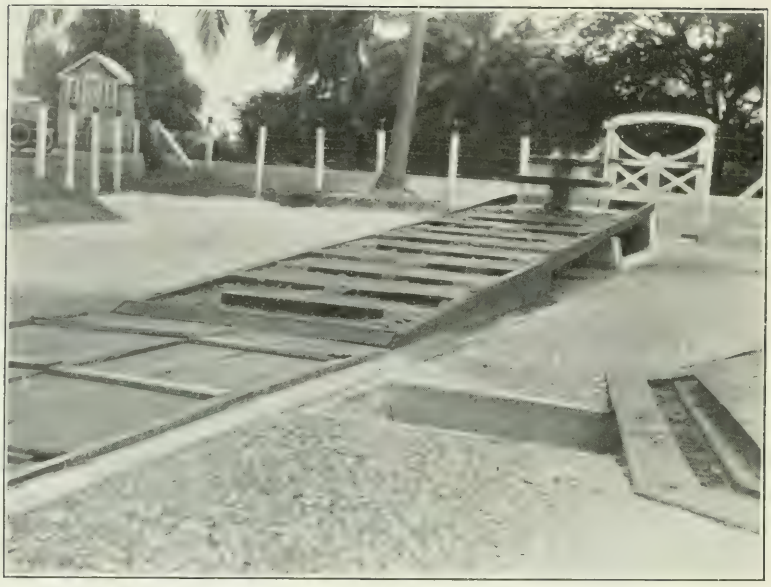
In order to render this artesian well-water palatable, it is necessary to remove the iron by free aeration and filtration, then to reduce the temperature by storage. Both these problems would be easy if funds were available to provide a large pumping and filtration plant, but only a small grant is available annually for this work. Mechanical plant is out of the question, on the ground of expense in installation and maintenance. As the country is dead flat the use of any form of gravity plant is precluded. The problem before the Public Works Department and the Health Department was briefly this, "How can we aerate, filter, cool and distribute this water when the water only rises about four feet above ground level in the well casing?" The attached plan shows the plant adopted, after consultation and on the advice of Mr. H. Beeby Thompson, the Consulting Engineer, who visited the colony in 1920. The installation of this water supply is due to the generosity of Mr. A. Duckham, who placed the sum of £1,000 at the disposal of the Government Medical Officer of Health for the purpose. The work was carried out by the Public Works Department, and when completed placed under the control of the Health Department and the Local Authority Many unforeseen difficulties arose during construction, not the least of these being that, in order to avoid "pitting" of the iron pipes, the whole of the 6in. mains had to be lined with bitumen, obtained from Trinidad at considerable expense. No motive power is used, and the plant is self-acting, the only working head available being the four feet to which the well-water rises above ground level, and the mains being laid at a depth of three feet below ground level, giving a total available head of seven feet. The water is raised from the main by means of pumps placed at suitable points throughout the village. The people, drawing the water themselves, supply the only motive power used throughout the system.

The explanation of the letters on plan will give the details of the working, perhaps, better than a written description. A very large quantity of iron is deposited before the water reaches the sand filter. It has been running for three months at present without cleaning the sand, but the surface of the filter is becoming thickly coated with deposited iron. In order to remove this, an arrangement for reversing the current through the filter has been fitted, and found to work satisfactorily. I anticipate that it will be necessary to clean the filter about every three months.

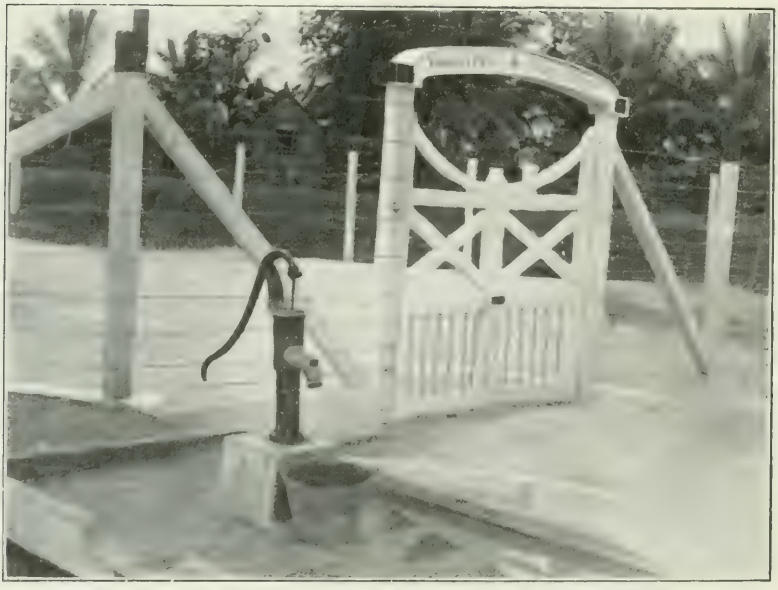
The following analyses were carried out by Sir J. B. Harrison, C.M.G., who also supplied the appended certificate of purity, etc. We are also

Showing perforated casing to well at water exit, with trays to spread out water and assist aeration.
Top of tray with baffle boards and large stones shown.

Spray, etc.—Showing double roof of storage tank beyond



View of spray and inclined plane shoot with baffle boards and large stones to collect deposited iron. Filter shown with wood covering closed.



Type of pump and concrete platform used to distribute water at roadside.

deeply indebted to him for many hints and suggestions for improvements during the construction :—

Samples taken by the Government Medical Officer of Health and the Director of Science and Agriculture on 9th December, 1921.

Elements and Ions.	Parts per 100,000 of Water. *Water flowing from casing.*	*Water aerated and filtered as delivered from main.*
Iron	·56	Nil.
Calcium	·55	1·09
Magnesium	·56	·78
Sodium with traces of potassium ...	2·67	1·51
Chlorine	1·84	1·84
Sulphate ion	·06	trace
Nitrous ion	·007	·003
Silicate ion	·95	1·27
Carbonate ion	3·96	2·61
	11·157	9·103

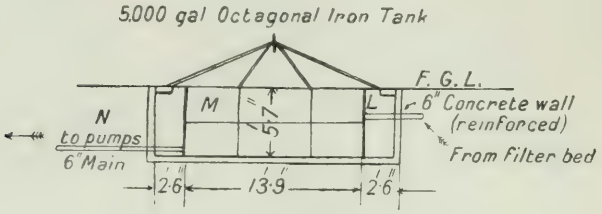
Sanitary Examination.	*Water as falling from casing.*	*Water as delivered from main.*
Dissolved oxygen, per cent. of possible	58·2	87·4
Relative proportion of free carbonic acid in solution	100	33
Oxygen absorbed from acid potassium permanganate at 82° F.	*Parts per 100,000 of water.*	
In 3 minutes	·08	Nil.
In 4 hours	·15	·25
Free Ammonia	less than ·001	less than ·001
Albuminoid ammonia	·001	·001
Nitrogen in nitrites	·002	·001

The water of the Nabaclis water-supply scheme, as delivered from the main, is brilliantly clear, colourless, tasteless and odourless ; it is well aerated and palatable ; while it exceeds in purity that of any other water-supply known to me in the West Indian Islands or in British Guiana. It is quite free from iron, while the origin of the water from aquifers, 770 to 850 feet below the surface of the ground, ensures its freedom from all organic pollution.

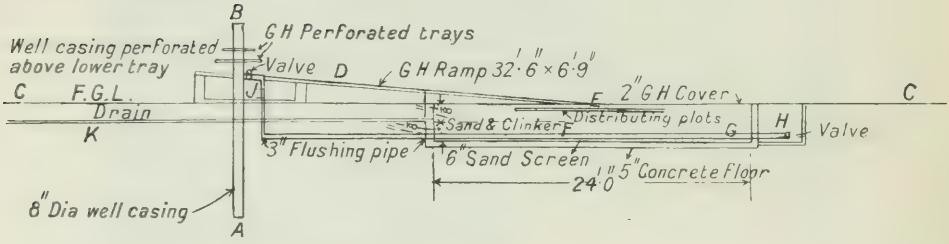
24th December, 1921. *(Signed)* J. B. Harrison.

It is now proposed to develop this system, and gradually provide the city of Georgetown and the towns and villages of the colony with a pure water supply on the above lines. Two of the larger sugar estates in the colony have also developed their artesian wells on similar lines, with slight modifications to suit local conditions. One estate raises the water, after treatment, into two large iron containers, and distributes the water throughout the ranges occupied by the labourers at a very small cost.

Considering the very high incidence of bowel complaints in the colony, generally due to defective water-supplies, I am certain that the gradual adoption of this form of water-supply will, from a health point of view, amply repay the initial cost.



Sectional Elevation Y--Y.



Sectional Elevation X--X

EXPLANATION OF LETTERS TO PLAN.

A. Well casing up from depth of about 560 feet, pipe is 8 inches diameter.

B. Outlet of well perforated at sides to break up water and increase aeration to get rid of Fe. by converting it from ferr*ous* to ferr*ic* state.

C. Ground level: this shows what a small amount of *head* we had to work with—only about four or five feet. (Four or five feet is about all we ever get.)

D. Sort of shoot, with baffle boards arranged as shown on ground plan, *B.* Spaces between filled with stones to further break up and aerate water.

E. Flat concrete table, perforated ½-inch holes, and with edges raised one inch all round to further spread out and aerate water. *Also* to prevent water falling all in one spot of sand-filter surface, and thus destroying scum in surface.

F. Layer of stones, gravel and fine sand to remove iron rendered insoluble by aeration, also to serve purpose of an ordinary filter.

G. Perforated pipe fitted with external strainer, which collects filtered water from the bottom of sand and conveys it into the storage tank.

H. Stop-cock to shut off water from going into tank when it is desired to reverse the current to clean the filter. (Same principle as Jewell filter, only adapted to this.)

I. Stop-cock to open when water is desired to pass down pipe, *J*, and reverse current to clean filter. Waste water after flushing passes down drain, *K*.

L. Entry pipe from filter to storage tank, *M*

N. Exit from storage tank to 6in. mains running along the road three or four feet below surface.

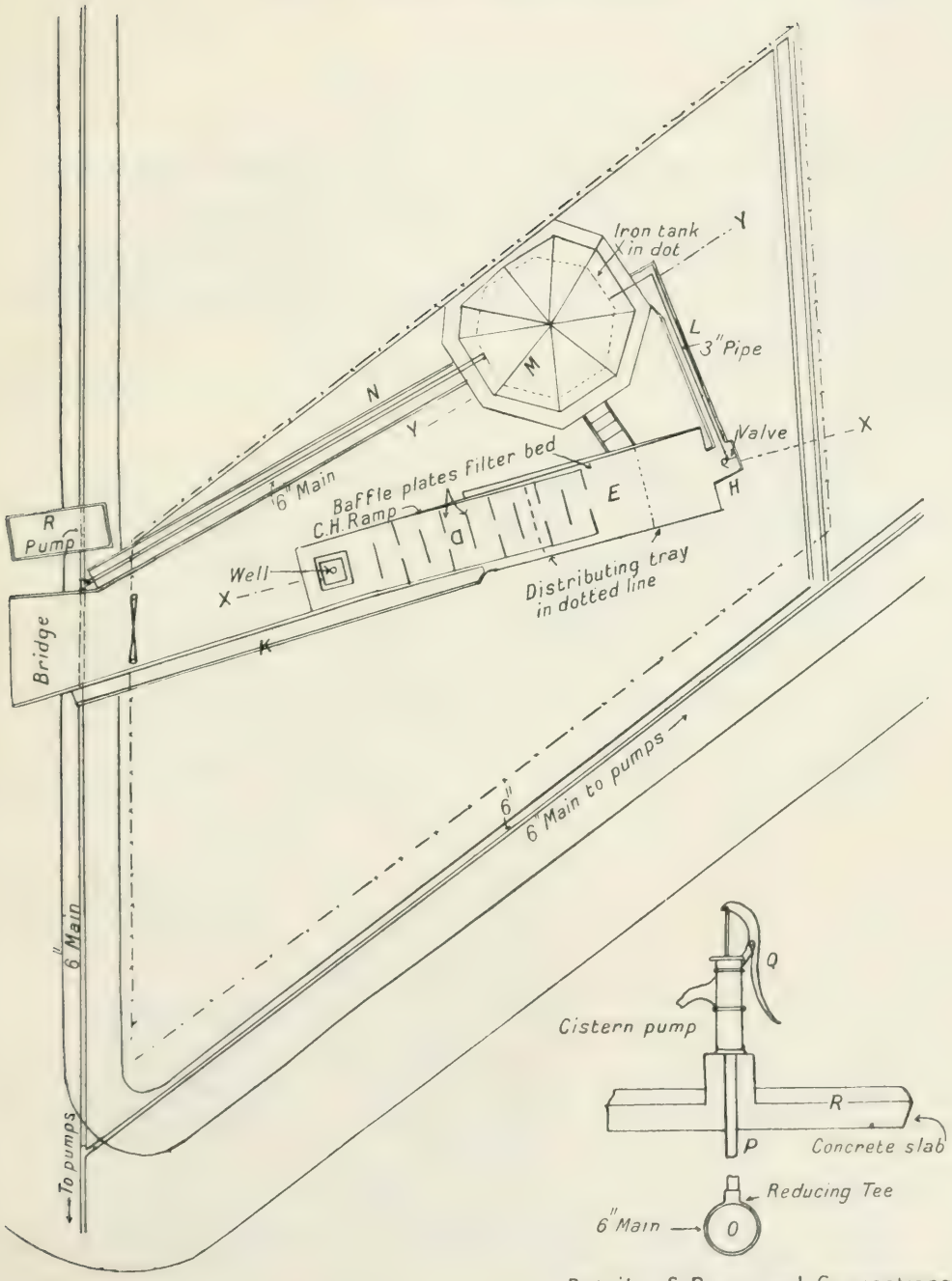
O. Main in section showing reducing tee.

P. Pump 2in diameter up to pump.

Q. Pump above ground level for drawing water.

R. Concrete slab round pump for standing buckets, etc., on.

AERATION AND FILTER PLANT, ARTESIAN WELL, NABACLIS VILLAGE.



Details of Pump and Connections.

AERATION AND FILTER PLANT, ARTESIAN WELL. NABACLIS VILLAGE.

NOTE ON A SMALL COLLECTION OF INDIAN TABANIDÆ AND OTHER BLOOD-SUCKING DIPTERA.

Formed by Captain H. E. Cross, I.C.V.D., Sohawa, Jhelum District, Punjaub, and received for examination from the Royal Society of Tropical Medicine and Hygiene.

By Major E. E. AUSTEN, D.S.O.

The collection, though small, is of considerable interest, and, as will be seen below, contains examples of several species which are apparently new. The occurrence in India of *Lipoptena caprina*, Austen, is especially worthy of note, since as yet this Hippoboscid is known only as a parasite of goats in Palestine.

The subjoined list, in addition to determinations by the present writer, also shows the names under which the examples of the various species were received, in order that differences in identification, if any, may readily be appreciated.

Serial No.	Family.	No. of Specimens.	Name.	Name as received.
i.	Tabanidæ	1	*Hæmatopota* sp. incert., prob. nov.	*Hæmatopota*, sp.
ii.	,,	4	*Tabanus striatus*, Fabr.	*Tabanus hilaris.*
iii.	,,	1	*Tabanus* sp., prob., nov.	*Tabanus bicallosus.*
iv.	,,	3	*Tabanus macer*, Big. (Syn. *T. bicallosus*, Ric.; *T. trichinopolis*, Ric.)	*Tabanus bicallosus.*
v.	,,	4	*Tabanus ditæniatus*, Macq.	*Tabanus ditæniatus.*
vi.	,,	4	*Tabanus albimedius*, Walk.	*Tabanus albimedius.*
vii.	,,	2	*Tabanus consocius*, Walk.	*Tabanus orientis.*
viii.	,,	3	*Tabanus nemocallosus*, Ric.	*Tabanus nemocallosus.*
ix.	,,	3	*Tabanus virgo*, Wied.	*Tabanus virgo.*
x.	,,	2	*Tabanus*, sp. nov.	*Tabanus sexcintus* (sic).
xi.	Muscidæ	2	*Philæmatomyia crassirostris*, Stein. (Syn. *Ph. insignis*, Austen).	*Philæmatomyia insignis.*
xii.	,,	1	*Stomoxys calcitrans*, L.	*Stomoxys calcitrans.*
xiii.	,,	1	*Stomoxys* sp. incert., nov. ?	*Stomoxys calcitrans.*
xiv.	,,	1	*Lyperosia exigua*, de Meij.	*Lyperosia exigua.*
xv.	Hippoboscidæ	2	*Hippobosca maculata*, Leach.	*Hippobosca maculata.*
xvi.	,,	1	*Lipoptena caprina*, Austen.	*Lipoptena* sp. near *cervi.*

LIST OF FELLOWS.

The following have been duly elected Fellows of the Society :—

George Phillip Farmer Allen, M.B., Ch.B., D.T.M., Jamaica.

Edward Morgan, M.R.C.V.S., D.V.H., Venezuela.

Rustom Pestonjee, M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.M.S. (Ceylon), Colombo, Ceylon.

Harry Chapman Sinderson, M.B., Ch.B. (Edin.), M.R.C.P. (Edin.), D.T.M. & H. (Lond.), Baghdad.

Lieut.-Col. Bawa Juvan Singh, I.M.S. (ret.), L.R.C.P., M.R.C.S. (Eng.), Hyderabad, India.

MOVEMENTS OF FELLOWS.

The following Fellows have notified the Secretaries that they are at present in England :—

J. Cotter Baker, M.B., India.

Major C. H. Bowle-Evans, C.M.G., India.

W. J. Bruce, M.R.C.S., Gold Coast.

G. G. Butler, M.B., Tanganyika.

Captain Neil Cantlie, M.C.

Donald W. Carr, M.D., Persia.

A. Connal, M.D., Lagos.

H. F. Conyngham, L.R.C.P., Borneo.

Major F. W. Cragg, M.D., I.M.S., India.

E. S. Crispin, C.B.E., Sudan.

H. Andrew Foy, L.R.C.P., Nigeria.

J. A. Griffiths, M.R.C.V.S., Nyasaland.

Colonel F. W. King, F.R.C.S., India.

D. D. Main, F.R.C.P., China.

W. E. Masters, M.D., Gold Coast.

E. P. Minett, M.D., British Guiana.

E. Morgan, M.R.C.V.S., Venezuela.

Alexander Noble, M.B., India.

W. H. Peacock, M.B., M.R.C.S., Sierra Leone.

E. J. Quirk. M.B.E., Nigeria.

H. H. Scott, M.D., Hong Kong.

A. F. Wallace, M.D., Rhodesia.

EDITORIAL NOTICES.

The Editor of the TRANSACTIONS will be pleased to receive short papers to be included under the heading of "Notes and Comments" or "Questions," in addition to longer papers on subjects of Tropical interest, which may be offered for presentation at meetings of the Society. He will also be glad to receive books for review.

Attention is drawn to the rule that Contributors of papers to the TRANSACTIONS receive 25 reprints free of charge, *provided they apply for these when sending the paper.*

Any communication for the Editor should be addressed to THE EDITOR of the TRANSACTIONS of the Royal Society of Tropical Medicine and Hygiene, 11, Chandos Street, Cavendish Square, W. 1.

Complete sets of the first four volumes of the TRANSACTIONS belonging to the Society have now become very scarce. If any Fellows possess these volumes, or any odd numbers of the same, and no longer require them, the Council would be greatly obliged if they could be presented to the Society.

There are frequent applications for these volumes from Libraries which are desirous of completing their sets. At the present time it is impossible to meet these requests, and it is felt that it would be doing a service to the cause of science to help them as far as possible.

ROYAL SANITARY INSTITUTE.

The Thirty-third Annual Congress and Exhibition of the Royal Sanitary Institute will be held at Bournemouth, from July 24th to 29th, 1922.

It has been arranged that part of the proceedings will be devoted to the consideration of Tropical Sanitation and Hygiene. The Royal Society of Tropical Medicine & Hygiene was invited to send a Delegate to the Congress, and Colonel W. WESLEY CLEMESHA, C.I.E., M.D., D.P.H., has been appointed to represent the Society.

It is hoped that Fellows who are home on leave will, if possible, attend the Congress, and assist in making this Section a success.

The subject of Colonel CLEMESHA'S address will be "The Methods of Collection and Disposal of Excreta in Small Oriental Villages."

NOTICE TO FELLOWS.

The Council of the Society have decided that, in view of the establishment of the TROPICAL DISEASES' LIBRARY at the London School of Tropical Medicine, 23, Endsleigh Gardens, Euston Road, N.W., it is no longer necessary to keep back-numbers of all the journals received for more than two years.

It was thought that Fellows of the Society might desire to avail themselves of this opportunity to complete or augment incomplete sets in Libraries or Institutes with which they may be connected.

Should any Fellow desire to take advantage of this disposal, he should apply to the Hon. Secretaries, 11, Chandos Street, Cavendish Square, W.1.

The following Periodicals are available :—

American Society of Tropical Medicine.
Annali di Medicina Navali e Coloniale.
Archives de l'Institut Pasteur de Tunis.
Archivos di Hygiene e Pathologia Exoticus.
Bulletin of Entomological Research.
Bulletin Officiale de la Secretaria, Sanidad y Beneficiencia, Habana, Cuba.
Bulletin de la Société Portugaise des Sciences Naturelles.
Geneeskundig Tjdschrift voor Nederlandsch-Indie.
Indian Medical Gazette.
Indian Journal of Medical Research.
Japan Medical World.
Journal of Tropical Medicine and Hygiene.
Journal of Tropical Veterinary Science.
Journal of Hygiene and Plague Supplement.
Kitasato Archives.
Mededeelingen von der Burgerlyken Geneeskundig Dienst in Nederlandsch-Indie.
Medical and Surgical Journal (New Orleans).
Memorias do Instituto Oswaldo Cruz.
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Public Health Notes—Treasury Department. U.S.A.
Review of Applied Entomology.
Revue de Medicine et d'Hygiene Tropicale.

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PUBLISHING NOTICES.

NOTICE TO FELLOWS.

A copy of the TRANSACTIONS will be posted regularly to every Fellow whose subscription is not in arrears during the Session.

Fellows are requested to give early intimation of any change of address, and in case of non-delivery of their copies of the TRANSACTIONS to communicate with the Secretaries as soon as possible. When copies of the TRANSACTIONS are returned by the Post Office, marked "gone away" or "insufficiently directed," no more copies will be posted to that address until further instructions have been received.

SPECIAL NOTE.—Complaints are sometimes received of the TRANSACTIONS not reaching Fellows abroad. In almost every instance, when the matter has been looked into, it has been found that the Fellow has changed his original address and has not notified this change to the Secretaries at home.

Unless this is done, it is impossible for the TRANSACTIONS to be regularly received, and the Secretaries hope that Fellows will be more careful about this in future.

All communications should be addressed to—

THE SECRETARIES,
ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE,
11, CHANDOS STREET, CAVENDISH SQUARE, W. 1.

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Fellows of the Society are reminded that they can only obtain their copies through the Secretaries.

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